ABSTRACT

A phase-locked loop apparatus includes a ring oscillator including inverters, first and second transistors, a converter, mirror circuits. The first transistors control a current from a first voltage to the inverters. The second transistors control a current from the inverters. The converter converts the voltage output from the filter into a current. The first mirror circuit outputs a current in accordance with the current output from the converters. The second mirror circuit outputs a current according to the current output from the first mirror circuit to control the first transistors. The third mirror circuit outputs a current according to the current output from the second mirror circuit to control the second transistors. The converter, the first and second mirror circuits operate with a second voltage greater than the first voltage, and the ring oscillator and the third mirror circuit operate with the first voltage.